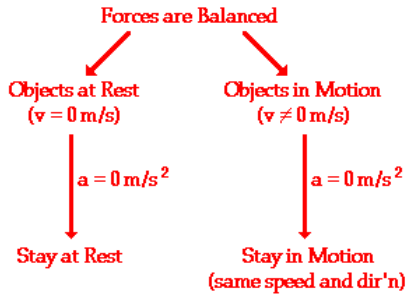
Forces and Newton's Laws Lab 2: Sudden Stops

Introduction

In this lab, students will explore newton's first law. Newton's first law describes the motion and acceleration of objects. There are two parts to the law. The first part says that an object at rest will stay at rest. The second part says that an object in motion will stay in motion. Both parts of the law have an addition that say "unless acted upon by a net force." Tying together what we have learned so far about velocity and acceleration, look at the diagram to the below. Another way of looking at this law is to say that objects will not accelerate unless a net force acts on them.



Pre-lab Questions

1. Can an object in motion have an acceleration of zero? If so, how?

2. In a car crash there are two collisions. The first one is when the car runs into the other car. What do you think the "second collision" is (hint: it's the one that hurts)?

3. Refer to the picture below. The car is about to run into the wall, the person is not wearing a seatbelt. Make a prediction about what will happen to the car and what will happen to the person in the car.

The car will….

The person in the car will….

Question / Aim: Describe situations with zero acceleration, and be able to explain the role of newton's first law and inertia in car crashes.
Independent Variable:
Dependent Variable:
Controlled Variable(s): Angle of ramp, mass used, mass of book, position of book, type of cart.

Hypothesis (circle guess)

As the cart is released higher up the ramp the mass will travel further once the cart is stopped.

As the cart is released higher up the ramp the mass will travel shorter once the cart is stopped.

Design

Supply List

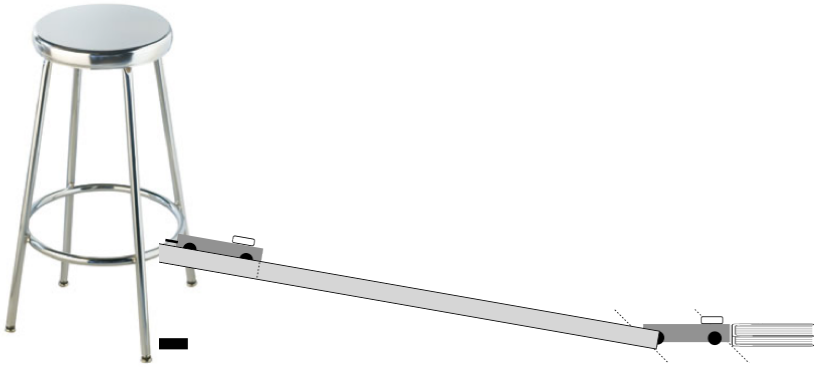
Lab stool with ramp, 100 g disc mass, dynamics cart, textbook, meter-stick, tape.

Procedure

1. Tape the ramp to the bottom rung of a tall lab stool. Measuring from the bottom of the ramp, place a piece of tape at the positions indicated in the data table and label their positions.

2. Position one textbook _____ 0.10 m from the base of the ramp on the lab bench. Place a piece of tape indicating the end of the ramp and the edge of the books. The books should have the bound end facing the ramp.

3. Position the cart so that the front wheels are above the 0.12 m mark and the open side is facing down the ramp. The cart should be placed so that the "bowl" side is facing the ramp. Place the mass on the front side of the cart closest to the bottom of the ramp. The mass should not be more than 0.05 m from the end of the cart.



4. Have one person hold the books, being sure not the obstruct the cart or mass, while you let the cart move down the ramp. Allow the cart to strike the books bring it to a stop.

5. Record the distance the mass flies from the cart. Your measurement should be from the piece of tape indicating the edge of the books to the furthest point of the mass.

6. Complete these steps so that three trails are obtained and an average is found of the mass' distance.

7. Repeat steps 1 – 6 for the additional starting positions.

Results

Presentation

Distance up Ramp (m)	Distance mass is thrown (m)			Average Distance (m) ((d1+d2+d3)/3)
	Trial 1	Trial 2	Trial 3	
0.12				
0.24				
0.36				
0.48				

1. Complete an excel graph of your data using the graphing guide and attach it to your lab. You are looking at the relationship between your two variables.

Evaluating Results

Conclusion

1. Using your graph, make a prediction of to how far you think the mass will travel if placed at 0.60 m up the ramp. Show your work.

2. Complete a trial for your prediction. Actual from trial: _____

3. Was your prediction about the car in the cartoon verified (proven true) by your experiments? Explain.

4. This lab involves the part of Newton's first law that says an object in motion will stay in motion unless acted upon by a net force. Two objects are in motion in this lab. What are they?

5. What is the main net force acting on either object?

6. The mass on the cart travels in the same direction as the cart. When the mass is thrown from the cart, in what direction does it go? Why does the mass go in that direction?

7. Explain how seat belts work in terms of Newton's First Law and use the words "inertia" and "net force" in your answer.